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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 15	)	**ET Docket 98-76**
of the Commission's Rules to	)	
Further Ensure That Scanning	)	
Receivers Do Not Receive	)	
Cellular Radio Signals	)	

To: The Commission

COMMENTS OF THE AMERICAN RADIO RELAY LEAGUE, INCORPORATD

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July 10, 1998

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The League requests that the Commission either create necessary exemptions for radio amateurs, or narrow the focus of its proposed regulations in this proceeding.

3. Specifically, the League requests that the Commission avoid a requirement that all scanning receivers in Amateur Radio transceivers and receivers block access to frequency control circuitry; it requests that amateur receivers not be required to undergo direct pickup immunity testing; that frequency converter or transverter kits for use in the Amateur Service not be prohibited entirely; and in any case, the Commission should define its terms relative to those devices more narrowly, so that radio amateurs can determine compliance more easily than the notice would indicate.

4. Notwithstanding the above, it is acknowledged that some amateur transceivers which incorporate scanning receivers, notably amateur transceivers with extended frequency receiver coverage, upon testing in the League's laboratory, have in the past demonstrated image responses that render them capable of receiving Cellular Service signals. Some of those devices exhibited sensitivity on the images that fall within the Cellular Service bands on the order of -120 dBm, which would be adequate to hear local Cellular signals.

5. This is largely not an issue in the Amateur Radio Service, as cellular image reception is not the purpose for which the transceivers are manufactured, marketed, purchased or utilized. Nor does it appear that such capability is widespread among devices of major manufacturers of amateur equipment. Fundamentally, it would not appear a significant burden for manufacturers of amateur products to be required to configure their devices to preclude the capability of cellular image frequency reception.

SUMMARY

The American Radio Relay League, Incorporated (the League), the national non-profit association of amateur radio operators in the United States, submits its comments in response to the *Notice of Proposed Rule Making* (the Notice), FCC 98-100, released June 3, 1998. The Notice proposes to strengthen, improve and clarify its rules prohibiting scanning receivers from receiving transmissions in the Cellular Radiotelephone Service. The League is concerned about the ancillary impact of the proposed regulations on the Amateur Radio Service.

The League's concern is that this proceeding stands to result in the enactment of additional, insufficiently defined regulations which would prohibit or unreasonably restrict the legitimate manufacture and sale of amateur communications and test equipment. It is also concerned on the part of many small businesses in the United States and elsewhere which manufacture and market legitimate amateur equipment, unrelated to cellular interception. Those product lines stand to be prohibited or made prohibitively expensive by overbroad regulations not necessary to the Commission's goal.

The League is cognizant of the Commission's obligation to restrict reception capability of scanners to preclude unlawful cellular intercept. There are elements of this proceeding that might properly be enacted which would be neutral toward existing amateur radio equipment used for legitimate purposes. However, other aspects of the Notice proposals constitute severe regulatory overkill. The Commission must be more sensitive to the adverse ancillary effects of its proposals on the Amateur Service, which is composed in the main of law-abiding radio experimenters and communicators who have no interest whatsoever in cellular interception. Access to microwave communications and test equipment is an important element of amateur communications. The Commission should not prohibit access to frequency converters or kits for the same; it should not require "potting" of frequency control circuitry or otherwise limit legitimate modifications of amateur radio equipment; and it should not unreasonably increase the cost of such equipment, or the cost of repair of it. Finally, the Commission should not require testing for direct pickup of cellular signals, due to the expense of such tests, and the absence of any indication that direct pickup is a material contributor to unlawful cellular access.

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In the Matter of	)	
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Commission's Rules to Further	)	
Ensure That Scanning Receivers	)	
Do Not Receive Cellular Radio	)	
Signals	)	

To: The Commission

COMMENTS OF THE AMERICAN RADIO RELAY LEAGUE, INCORPORATED

The American Radio Relay League, Incorporated (the League), the national non-profit association of amateur radio operators in the United States, by counsel and pursuant to Section 1.415 of the Commission's Rules (47 C.F.R. §97.415), hereby respectfully submits its comments in response to the *Notice of Proposed Rule Making* (the Notice), FCC 98-100, released June 3, 1998. The Notice proposes to strengthen, improve and clarify its rules prohibiting scanning receivers from receiving transmissions in the Cellular Radiotelephone Service. Relative to the impact of the proposed regulations on the Amateur Radio Service, the League states as follows:

I. Introduction

1. The League is sensitive to the Commission's concern that devices not be readily available to unlawfully intercept cellular transmissions. The League actively participated in the Commission's prior proceedings implementing the Telephone Disclosure and Dispute Resolution Act, Pub. L. 102-556, in ET Docket 93-1.[1] In that proceeding, the Commission first enacted regulations intended to increase the privacy protection of cellular users without unduly restricting

[1] See the *Report and Order*, FCC 93-201, 8 FCC Rcd 2911 (1993); request for extension denied, 75 RR 2d 982 (1994).

the legitimate uses of scanning receivers. Licensed radio amateurs, in the course of their avocational pursuits, or in the provision of emergency, disaster relief, or public service/public safety communications do not need to monitor cellular telephone transmissions. Therefore, there is no reason why amateur equipment must or should have that capability. Nor need amateur equipment be configured so that it can be modified to enable that capability. Most commercially made amateur equipment in fact does not have that capability. The League's concern herein, and one which is widespread among law-abiding radio amateurs, is that this proceeding stands to result in the enactment of additional, insufficiently defined regulations which would prohibit or unreasonably restrict the legitimate manufacture and sale of amateur communications and test equipment. The League is concerned on behalf of its members and others who use that equipment. It is also concerned on the part as well of many small businesses in the United States and elsewhere which manufacture and market legitimate amateur equipment, unrelated to cellular interception. Those product lines stand to be prohibited or made prohibitively expensive by regulations not necessary to the Commission's goal.

2. The Commission, albeit well-intentioned, has a history of regulatory actions in proceedings not directly related to the Amateur Service, but which have adverse consequences for amateurs. For example, in an effort to restrict unlawful manufacture, sale and use of linear amplifiers in the Citizen's Radio Service, the Commission unnecessarily regulated the frequency coverage of amateur radio amplifiers when other sufficient, less burdensome alternatives were available. See, e.g., *American Radio Relay League, Incorporated v. Federal Communications Commission*, 617 F.2d 875 (D.C. Cir. 1980). The instant proceeding has the same potential ancillary impact; one which is not necessary in order for the Commission to achieve its goal.

II. The 38-dB Rejection Standard

6. Although the text of the Notice addresses principally the image response of receivers, the language of the proposed rule[2] is not limited to cellular image frequencies, but would apply to *any* spurious response of the subject receiver. The League does not oppose the requirement that scanning receivers reject reception of cellular signals by at least 38 dB. From demonstrations in the League's laboratory of image rejection *in amateur bands*, it may be concluded that this level of receiver performance should not be difficult for manufacturers to meet. Most amateur equipment that has been tested over the years meets this specification in its image rejection, as documented in the Appendices attached hereto. This level of rejection is relatively simple to design and test, and the test methods are simple enough to describe as part of the application for equipment authorization.

7. The language of the proposed Section 15.121(b) would require that receivers, *on any tunable frequency*, reject Cellular Service signals by at least 38 dB compared to the "minimum receiver sensitivity for the tunable frequency." The most precise interpretation of this language is that the spurious response is referenced to the sensitivity at the frequency being tuned at the time, with the term "minimum" being included to indicate that the receiver bandwidth and preamplifier conditions should be set to obtain the best sensitivity. This interpretation is not, presumably, what the Commission intends. If it is, it could present a distinct problem for amateur equipment manufacturers. One of the transceivers tested in the League's laboratory, for example, exhibited a sensitivity at 750 MHz of - 66 dBm, which is extremely poor. To meet the 38 dB requirement, the device would be required to exhibit sensitivity on the cellular image

[2] See, proposed Section 15.121(b), Appendix B of the Notice.

frequency of -28 dBm, which is far more strict than necessary, and much more difficult to achieve as a practical matter.

8. An alternative interpretation, and what the League presumes is intended by the Notice, is that the reference is to the point of *best* sensitivity across the receiver's tuning range. Some wideband amateur receivers are technically capable of receiving across the entire range, but the receiver sensitivity at the point where Cellular Service images could be a problem is exceptionally poor: more than 38 dB worse than the typical sensitivity of the receiver when tuned to the amateur bands. The Notice mentions 0.5 uV as a "typical" scanning receiver sensitivity. It would be fair to reference the 38 dB to that level, requiring that receivers exhibit spurious response to signals on cellular service frequencies less than a 12 dB SINAD for input levels of 40 uV (the level that is 38 dB higher than 0.5 uV).

9. Testing conducted spurious rejection is relatively simple, although to be comprehensive, the testing should include more than just image rejection. In addition, all spurious responses to cellular signals should be determined, and under the Notice proposal, such would be required. To test narrow-band FM receivers used by amateurs, a carrier is modulated with a 1 kHz tone, at 3 kHz deviation. First, the 12 dB SINAD (S/N ratio that includes distortion products) is measured "on channel" and the result is recorded. The generator is then tuned to the image (or other spurious-response) frequency, and the level is increased until a 12 dB SINAD is again obtained. The difference between the level of desired signal and image signals that caused a 12 dB SINAD is the spurious rejection, usually expressed in dB. Manufacturers should have no difficulty making the required measurements. The additional spurious-rejection measurement should not add significantly to the cost of obtaining a grant of

equipment authorization.

10. However, the language of the proposed rule is not specific relative to modulation conditions used in testing, and so it is confusing. The language of the rule should stipulate test conditions, at least in general terms. For example, 15.121(b) should be revised to read as follows:

> Except as provided in paragraph (c) of this section, scanning receivers, on any tunable frequency, must reject any signals from the Cellular Radiotelephone Service frequency bands that are up to 38 dB higher than the minimum receiver sensitivity for the tunable frequency. This standard is based on a measured signal-to-noise ratio **using test tones with modulation suitable for the receiver bandwidth and mode . . .**

It is reasonable to ask manufacturers to describe the conducted image rejection test methods as part of the Certification process. The description of the radiated image rejection will be more difficult, but not nearly as difficult as the test itself, as will be discussed hereinbelow.

III. Modifications and Circuit Accessibility

11. The Commission's rules currently define scanning receivers which are "capable of readily being altered" as including those which are cellular-enabled by "clipping the leads of, or installing, a simple component such as a diode, resistor or jumper wire; replacing a semiconductor chip; or programming a semiconductor chip using special access codes or an external device, such as a personal computer." The Notice asks whether this is inclusive enough. In the League's opinion, it is. Nor does the League object to the regulation of scanning receivers to prohibit simple modifications to preclude cellular intercept. In the past, some devices have been configured so that they can be simply modified by removing or adding a jumper, or by combinations of front-panel commands from a touch-tone pad to modify software in the device. While most amateur equipment manufacturers do not program these capabilities into their

equipment, some equipment appears to have been designed to facilitate "aftermarket" modifications to receive cellular frequencies. The prohibition of these modifications does not adversely affect the Amateur Service. The prohibition of such modifications, however, should be sufficient by itself to address cellular intercept modifications. The remainder of the Commission's proposal in this respect is severe overkill and is harmful to legitimate amateur operation.

12. The Notice, at Paragraph 10, proposes to require that scanning receivers be designed so that "tuning and control circuitry is inaccessible", and that the design be such that "any attempt to modify the scanning receiver to receive cellular service transmissions will likely render it inoperative." Examples are either coating the control and tuning circuitry with epoxy to prevent access, or encasing the control and tuning circuitry in a metal compartment that cannot be removed. This is an overbroad requirement, since most amateur scanning receivers incorporated in transceivers would have to essentially be rebuilt, or firmware replaced, in order to receive cellular frequencies. "Potting" of the frequency control hardware is simply unnecessary for most amateur equipment. Furthermore, the requirement is antithetical to what is essentially an experimental radio service. Amateurs who purchase commercial transceivers often repair that equipment themselves, and take pride in doing so. Some modify it for experimentation purposes, and in order to use it in new developmental and operational applications. Regularly, amateur licensees are involved in Civil Air Patrol (CAP) and Military Affiliate Radio System (MARS) operation. The frequencies for MARS and CAP are proximate to amateur bands, and amateur equipment is regularly modified to permit coverage of those frequencies. MARS and CAP equipment need not be type-accepted, and do not, given the size

of those services, justify separate equipment lines from manufacturers. Precluding any frequency circuitry access would make amateur equipment unusable for MARS and CAP, and remove essentially the sole source of equipment for those services.[3] The restriction would make all of the foregoing impossible. Cellular blocking in amateur equipment, in order to be effective, does not require potting.

13. From a manufacturer's perspective, potting is not free. Most manufacturers are not equipped to do high-volume potting, so this would all need to be done by hand. This is an expensive additional burden, regardless of where the devices are manufactured. Inevitably, this will be reflected in significant price increases for amateur equipment. The requirement would also add considerably to the costs of diagnostic work and repair of equipment by the manufacturer, which would add considerably to the cost of repair to the radio amateur. For example, a "cold solder joint" inside the potted unit could no longer be economically repaired -- potting would virtually ensure that the only repair and modification that could be done to equipment would be at the circuit board level.

14. In many cases, the "control" of the permitted transmit and receive frequency ranges in modern amateur equipment is accomplished in firmware. In some instances, manufacturers have made upgrades and improvements to their firmware and made those improvements available to their customers. To comply with the Notice proposal, the manufacturer would have to encapsulate the firmware, too, making it impossible for a buyer to take advantage of product improvements. While most manufacturers of amateur portable and mobile equipment do not

[3] The Commission has been made aware of the need to protect MARS and CAP operation, and has stated its intention to do so in the context of precluding cellular intercept by scanning receivers. See the *Memorandum Opinion and Order*, 75 RR 2d 982 at 983-4 (1994).

incorporate easily changed firmware, current amateur high-frequency transceivers incorporate VHF and UHF bands as well, and include scanning functions, so this requirement would impose a burden on customers who would have to replace an entire subassembly in order to utilize the latest firmware upgrade.

15. In addition, the requirement to make "tuning and control circuitry" inaccessible might be interpreted to require manufacturers to make the front-end filtering circuitry inaccessible. Otherwise, it would be possible to modify equipment by removing the filtering that had been added to meet the 38 dB image suppression requirement. If such an interpretation is imposed (and the vagueness of the term "tuning and control circuitry" is of little assistance in this context), then compliance with this requirement would make amateur equipment expensive to purchase; expensive to repair; not subject to repair by the licensee; not modifiable for new applications; and not useful for experimental purposes. These limitations are applicable whether or not the device has any inherent capacity whatsoever to be modified for reception of cellular frequencies. The potting requirement is severe regulatory overkill and should not be enacted. There are sufficient, less burdensome regulations now in effect, and as proposed in the instant Notice.

IV. Radiated Image Rejection

16. The Notice, at paragraph 8, states the Commission's concern that some scanning receivers may be subject to direct pickup of the image frequency by the unit's circuitry through the cabinet, rather than through the antenna input. To that end, it is proposed that the devices be incapable of receiving an external signal at a field strength of 5 mV/m. This corresponds to the 38 dB image rejection level requirement, and it is speculated that such level could be met

by most current amateur transceivers. However, to measure this accurately would require an RF "anechoic" chamber and calibrated field strength monitoring equipment, or other such devices as TEM or GTEM cells.

17. If test data on radiated response to the image frequency is required in the Equipment Authorization process, it will substantially increase the cost of amateur equipment. Most manufacturers lack the required test equipment and personnel to conduct those tests "in-house" and must contract them to a testing laboratory. To meet Part 15 requirements, units must be tested for radiated emissions, but these are among the more difficult and costly of the tests performed by manufacturers. Adding another complex and expensive test will substantially increase design costs and design time, and hence product cost to the consumer.

18. The language of this part of the Notice is also imprecise. the Notice requires that a scanning receiver "not be able to receive" signals in the cellular bands of 5 mV/m. This is not sufficiently defined. If the Commission intends to apply the same 12 dB SINAD threshold for this specification that is to be applied to other provisions, then the proposed rule should so state.

V. Kits for Frequency Converters and Transverters

19. The Notice, at paragraph 7, notes that under current regulations, kits (broadly defined in Section 15.3(p) of the Commission's Rules as "any number of electronic parts, usually provided with a schematic diagram or printed circuit board, which, when assembled in accordance with instructions, results in a device subject to the regulations in Part 15, even if additional parts of any type are required to complete assembly.") are not subject to the Commission's Equipment Authorization Program. This is true even if the device, when

completed, would be subject to equipment authorization. The Notice states that it would be difficult to enforce a regulation that required scanning receiver and frequency converter kits to block cellular service frequencies, so instead, it proposes to prohibit importation and manufacture of scanning receiver and frequency converter kits that are capable of receiving and decoding signals from cellular service bands.

20. The proposal to prohibit the manufacture and marketing of scanning receiver kits or frequency converter kits that are "capable" of receiving and decoding signals from the cellular service bands has a direct, though unintended, adverse effect on the Amateur Service, and the proposal is conceptually flawed. First, presumably because the "capable of receiving" definition is not, and cannot be adequately defined, the proposed Rule [Section 15.121(e)] simply prohibits kits for *all* scanning receivers and frequency converters designed for use with scanning receivers. This is an exceptionally overbroad provision. Second, as the Commission notes, in the absence of equipment authorization requirements for kits, the prohibition contained in the Notice cannot be enforced to any greater degree than could a requirement that a kit be designed to block cellular service frequencies. The fact is that Congress directed the Commission to address scanning receivers and frequency converters that are capable of receiving cellular service frequencies, not more than that. In 1993, the Commission stated its express intention to *avoid* prohibitions of frequency converters:

> While the [Telephone Disclosure and Dispute Resolution Act] does not specifically address frequency converters it does prohibit the authorization of scanning receivers that are capable of being readily altered by the user to receive cellular transmissions. Frequency converters that tune cellular frequencies can be easily and readily used, with virtually any existing scanner, to intercept cellular communications. Rather than prohibit all scanners because of the availability of

> frequency converters, we believe it is more prudent to restrict the tuning capability of these converters (footnote omitted).
>
> *Id.*, 8 FCC Rcd. at 2912.

The Commission now cites no instance in which the existing regulation on the tuning capacity of these converters has proven ineffective, and therefore no reason why it need now prohibit such converters entirely.

21. The prohibition of "frequency converter" kits is especially troublesome for the Amateur Service. Most transverters, for example, are fairly broadband and a wide range of input frequencies can be received by the selection of the IF output. The only way to ensure that one of these is "not capable" of receiving cellular frequencies would be to design them with narrow-band front ends. Even then, they could be easily modified by replacing those front-end components. Neither would a "potting" requirement have any application to such devices. These devices are used by very large numbers of amateurs who operate on microwave frequencies, together with high-frequency transceivers which incorporate scanning receivers. Microwave equipment companies, whose products are regularly relied on by amateurs to develop equipment for operation at 902-928 MHz and 1240-1300 MHz would have their product lines, all of which are designed and used for legitimate amateur radio operation, prohibited by the proposed rule. The net effect of the Commission's overbroad requirement would be to prohibit any frequency converters, *even though that equipment is not used, and would not be useful, for reception of cellular frequencies.* The other result would be that, because commercially-manufactured transceivers for amateur microwave bands are generally unavailable, and because amateurs therefore rely on transverters and kits, amateur access to its own microwave allocations would become prohibitively expensive or, due to equipment unavailability, impossible. The

Commission must either create an exception for frequency converters for use in the Amateur Service, or enact a less overbroad regulation which would allow amateur frequency converters and kits to be continued to be marketed. There is precedent for this. In its 1993 Report and Order in Docket 93-1, the Commission exempted cable television converters "or other devices that might be able to receive cellular telephone transmissions but were not designed for that purpose" from converter regulations adopted at that time. 8 FCC Rcd. at 2912, footnote 15. The Commission cannot treat similar circumstances in a discriminatory fashion, and must make provision for amateur frequency converters for microwave communications purposes.

VI. Scanning Receiver and Test Equipment Definitions

22. The Commission's scanning receiver definition currently includes the ability to scan 4 or more frequencies in the 30-960 MHz range. The Notice, at paragraphs 15 and 16, asks whether the definition should be modified to include manual tuning receivers and not just scanners. The League would suggest that restrictions on manual tuning receivers vastly expand on any statement of Congressional intent, and would expand an already overbroad regulatory framework for radio receivers. There is no record or evidence that manually-tuned receivers contribute materially to unlawful cellular interception, and thus no reasonable basis on which the Commission should impose restrictions at the present time.

23. In the Part 15 definition of "scanning receivers", there are exemptions. One exemption is "receivers designed solely for reception of broadcast signals under Part 73 of this chapter or for operation as part of a licensed station". Thus, as the Notice recites, receivers within transceivers that operate in the cellular service, for example, are not covered. The exemption is unclear, but would appear to apply to amateur equipment as well. If so, that should

be clarified in any report and order adopted in this proceeding. It would address each of the foregoing concerns herein. Amateur scanning receivers contained in transceivers are used "as part of a licensed station" to the same extent as are receivers within transceivers in the cellular service, to use the Notice example. Therefore, based on that definition, amateur equipment should be exempt from the requirements as well. If this is not the Commission's intention, it should so specify, and should create necessary exemptions and clarifications to address the concerns of the Amateur Service set forth herein.

24. Another exemption proposed as Section 15.3(cc) in Appendix B to the Notice is for test equipment. However, the Notice, at paragraph 17, proposes to define test equipment as that equipment that is not marketed or sold to the general public and is used by "professional technical personnel in conjunction with testing of equipment or systems or for scientific investigations." Test equipment is not limited in its use to "professional" technical personnel. Radio amateurs have every bit as much legitimate need for the use of test equipment as do wireless, broadcast or cable technicians and engineers, and the definition of test equipment in this context is unreasonably limiting. Manufacturers should not be limited in their ability to market legitimate test equipment to amateurs. Removing the term "professional" in the definition would solve the problem.

VII. Conclusions

25. While the League is cognizant of the Commission's obligation to restrict reception capability of scanners to preclude unlawful cellular intercept, and there are elements of this proceeding that might properly be enacted which would be neutral toward existing amateur radio equipment used for legitimate purposes, there are other aspects of the Notice proposals that

constitute severe regulatory overkill. The Commission must be more sensitive to the adverse ancillary effects of its proposals on the Amateur Service, which is composed in the main of law-abiding radio experimenters and communicators who have no interest whatsoever in cellular interception. Access to microwave communications and test equipment, however, is an important element of amateur communications. The Commission should not prohibit access to frequency converters or kits for the same; it should not require "potting" of frequency control circuitry or otherwise limit legitimate modifications of amateur radio equipment; and it should not unreasonably increase the cost of such equipment, or the cost of repair of it. Finally, the Commission should not require testing for direct pickup of cellular signals, due to the expense of such tests, and the absence of any indication that direct pickup is a material contributor to unlawful cellular access.

Therefore, the foregoing considered, the American Radio Relay League, Incorporated respectfully requests that the Commission modify the Notice Proposal and the proposed text of

its rule changes in accordance with these Comments.

Respectfully submitted,

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APPENDICES

These tables indicate the image rejection performance for several amateur radio transceivers and wide band communications receivers recently tested by the League's laboratory for *QST* magazine product reviews.

Table 1 -- FM Hand-Held Transceivers

Manufacturer	Model	Transmit Frequency Coverage	Review Date	VHF Image Rejection	UHF Image Rejection	Notes
ADI	AT-201	2-M	12/97	77 dB	-	
	AT-600	2-M/70-CM	4/98	80 dB	44 dB	
Alinco	DJ-G5TH	2-M/70-CM	7/97	124 dB	66 dB	
	DJ-S11T	2-M	12/97	57 dB	-	
	DJ-190T	2-M	12/97	67 dB	-	
	DJ-191	2-M	10/96	65 dB	-	
	DJ-582T	2-M/70-CM	7/95	66 dB	55 dB	
Drake	TR270	2-M	11/97	94 dB	94 dB	
Icom	IC-T2A	2-M	12/97	116 dB	-	
	IC-T7A	2-M/70-CM	7/97	85 dB	67 dB	
	IC-T22A	2-M	5/96	69 dB	-	
	IC-W32A	2-M/70-CM	7/97	82 dB	60 dB	
	IC-Z1A	2-M/70-CM	7/95	80 dB	69 dB	
Kenwood	TH-G71A	2-M/70-CM	4/98	125 dB	88 dB	
	TH-22AT	2-M	5/96	85 dB	-	
	TH-79A(D)	2-M/70-CM	7/96	79 dB	72 dB	
	TH-235A	2-M	12/97	133 dB	-	
Midland	73-030	2-M	12/97	57 dB	-	
Standard	C108	2-M	5/96	67 dB	-	
	C156	2-M	12/97	66 dB	-	
	C178	2-M/70-CM	5/96	78 dB	20 dB	
	C508	2-M/70-CM	7/97	73 dB	46 dB	Extended RX 902 MHz: -7 dB
	C510	2-M/70-CM	4/98	67 dB	79 dB	
	C568	2-M/70-CM	7/95	52 dB	65 dB	
Yaesu	FT-10R	2-M	5/96	80 dB	-	
	FT-11R	2-M	5/96	61 dB	-	
	FT-51R	2-M/70-CM	7/95	66 dB	62 dB	
	FT-50R	2-M/70-CM	7/97	82 dB	50 dB	Extended RX 902 MHz: -3 dB
	VX-1R	2-M/70-CM	4/98	70 dB	50 dB	

Table 2 -- FM Mobile Transceivers

Mfgr.	Model	Transmit Frequency Coverage	Review Date	VHF Image Rejection	UHF Image Rejection	Notes
ADI	AR-146	2 M	11/96	62 dB	--	
Alinco	DR-150T	2-M	11/96	94 dB	23 dB	
	DR-600T	2-M/70-CM	6/93	85 dB	79 dB	
	DR-605T	2-M/70-CM	12/96	76 dB	76 dB	
	DR-610T	2-M/70-CM	12/96	99 dB	81 dB	
	ICOM					
ICOM	IC-2000H	2-M	11/96	63 dB	-	
	IC-2340H	2-M/70-CM	11/95	82 dB	94 dB	
	IC-2410H	2-M/70-CM	6/93	84.5 dB	81 dB	
	IC-2700H	2-M/70-CM	11/95	90 dB	97 dB	
	IC-2710H	2-M/70-CM	12/96	90 dB	89 dB	
	IC-3230H	2-M/70-CM	6/93	82 dB	86 dB	
Kenwood	TM-261A	2-M	11/96	120 dB	-	
	TM-732A	2-M/70-CM	6/93	140 dB	85 dB	
	TM-733A	2-M/70-CM	11/95	136 dB	87 dB	
	TM-742A	2-M/6-M/70-CM	11/95	78 dB	74 dB	6-M: 138 dB
Radio Shack	HTX-242	2-M	11/96	72 dB	-	
Ten Tec	T-kit 1220	2-M	11/96	64 dB	-	
Standard	C5718DA	2-M/70-CM	11/95	85 dB	68 dB	
	C5608DA	2-M/70-CM	6/93	81 dB	86 dB	
	C5900DA	2-M/6-M/70-CM	12/96	89 dB	54 dB	6-M: 79 dB
Yaesu	FT-3000M	2-M	11/96	85 dB	31 dB	800MHz: 3 dB
	FT-5100	2-M/70-CM	6/93	94 dB	73 dB	
	FT-5200	2-M/70-CM	11/95	128 dB	62 dB	
	FT-8000R	2-M/70-CM	12/96	78 dB	95 dB	
	FT-8500	2-M/70-CM	11/95	80 dB	92 dB	

Table 3 -- Multimode VHF/UHF Transceivers

Manufacturer/ Model	Transmit Frequency Coverage	Review Date	VHF Image Rejection	UHF Image Rejection	Notes
ICOM					
IC-820H	2-M/70-CM	3/95	78 dB	86 dB	
IC-821H	2-M/70-CM	3/97	79 dB	83 dB	

Table 4 -- Communications Receivers

Manufacturer/ Model	Receive Range	Review Date	VHF Image Rejection	UHF Image Rejection	Notes
ICOM IC-8500	0.1-824; 849-870; 894-2000 MHz	4/97	102 dB	-	Tested at VHF only